

A TAXONOMIC REVIEW OF THE GENUS *DELPHINIOBIUM* MORDVILKO
(HOMOPTERA: APHIDIDAE) IN CHINA

GE XIA QIAO AND GUANG XUE ZHANG

Institute of Zoology, The Chinese Academy of Sciences, 19 Zhongguancun Lu, Haidian, Beijing 100080, People's Republic of China (e-mail: leifm@panda.ioz.ac.cn)

Abstract.—The aphid genus *Delphiniobium* Mordvilko from China is reviewed. There are four species in China, *Delphiniobium gyamdaense* Zhang, *D. yezoense* Miyazaki, *D. violisuctum* Qiao and Zhang, n. sp., and *D. aconitifoliae* Zhang and Qiao, n. sp. A key to species from China, morphological descriptions, distributions, host plants, and diagnosis of new species are provided. In addition, the apterous viviparous female of *D. gyamdaense* Zhang is described for the first time.

Key Words: Homoptera, Aphididae, *Delphiniobium*, new species, China

Mordvilko (1914) erected the genus *Delphiniobium* for the species *Myzus junackianum* Karsch 1887. Hille Ris Lambers (1947) studied the genus *Delphiniobium* from Europe. At present, this genus is represented by eight species and one subspecies, *D. bogdouli* Szelegiewicz 1969, *D. canadense* (Robinson 1968), *D. carpaticae* Mamontova 1966, *D. hanla* Paik 1971, *D. junackianum* (Karsch 1887), *D. junackinum sylvanae* (Knechtel and Manolache 1944), *D. lycoctoni* Börner 1950, *D. yezoense* Miyazaki 1971 and *D. gyamdaense* Zhang 1981 (Remaudière and Remaudière 1997). In the course of the present study, two new species, *D. aconitifoliae* Zhang and Qiao and *D. violisuctum* Qiao and Zhang are described from China, plus two other species, *D. gyamdaense* Zhang and *D. yezoense* Miyazaki. A key to species in China is provided. In addition, the apterous viviparous female of *D. gyamdaense* Zhang 1981 is described for the first time.

MATERIALS AND METHODS

All specimens studied including types are housed in the Zoological Museum, Institute

of Zoology, the Chinese Academy of Sciences, Beijing.

Aphids were mounted on microscope slides in Arabic gum, and observed under phase contrast microscopy. Terminology follows Miyazaki (1971). Drawings were made by the first author, Dr. X. L. Chen, and Mr. T. S. Zhong using microscopy. Measurements are in millimeters.

Delphiniobium Mordvilko 1914

Delphiniobium Mordvilko 1914: 65.

Type-species: *Myzus junackianum* Karsch 1887 (= *Rhopalosiphum aconiti* van der Goot 1912). By monotypy.

Generic diagnosis.—Body elliptical. Medial frontal tubercle undeveloped or developed, lateral frontal tubercles with diverging inner sides present. Thoracic stigmal pores much longer than abdominal stigmal pores. Spiracular sclerites of thorax strongly produced, with opening very large and round. Mesosternal furca with short or long stem. Antennal segment III with large and small round secondary rhinaria. Ultimate rostral segment stout. First tarsal segment chaetotaxy: 3, 3, 3. Siphunculi slender,

slightly or distinctly swollen, with distinct reticulation consisting of several rows of hexagonal cells near apex, paler than cauda basally. Cauda dark, long tapering. Mainly on *Aconitum* and *Delphinium*.

In general aspects this genus resembles *Megoura* Buckton, from which it can be easily separated by the reticulated apices of the siphunculi. On the other hand many *Macrosiphum*-like species in America have swollen siphunculi with a reticulated area, but in none of them a black, sclerotic cauda occurs. Other genera with swollen siphunculi have either no reticulated area (*Amphorophora* Buckton), or (*Rhopalosiphoninus* Baker) often no rhinaria on the antennal segment III in apterous viviparous females.

Distribution.—Europe (Romania, England, Netherlands, Germany, Russia), North America (Canada), Asia (China, Japan, Korea, Mongolia).

KEY TO APTEROUS VIVIPAROUS FEMALES OF SPECIES FROM CHINA

- 1. Medial frontal tubercle not developed, antennal tubercles small (Fig. 22); abdominal tergite 1 with 14 hairs; ultimate rostral segment with 2 pairs accessory hairs; China: Shanxi (Yangcheng County) *Delphiniobium violisuctum*
Qiao and Zhang, n. sp.
- Medial frontal tubercle developed, antennal tubercles large (Figs. 1, 15); abdominal tergite 1 with at most 10 hairs; ultimate rostral segment with 3–5 pairs accessory hairs 2
- 2. Siphunculi slightly or distinctly swollen in middle; ultimate rostral segment at most 1.30 times as long as second hind tarsal segment; antennal segment III with either at most 25 secondary rhinaria or at least 44 3
- Siphunculi not swollen; ultimate rostral segment 1.35 times as long as second hind tarsal segment; antennal segment III with 21–39 secondary rhinaria; China: Beijing (Sanpu District, Xiaolongmen District)
. *Delphiniobium aconitifoliae*
Zhang and Qiao, n. sp.
- 3. Antennal segment III with 44–57 secondary rhinaria, on basal 3/4 of segment; siphunculi distinctly swollen (Fig. 20); China: Qinghai (Huzhu County), Xizang (Gyamda County)
. *Delphiniobium gyamdaense* Zhang
- Antennal segment III with 10–25 secondary rhinaria, on basal half of segment; siphunculus slightly swollen; China: Sichuan (An County),

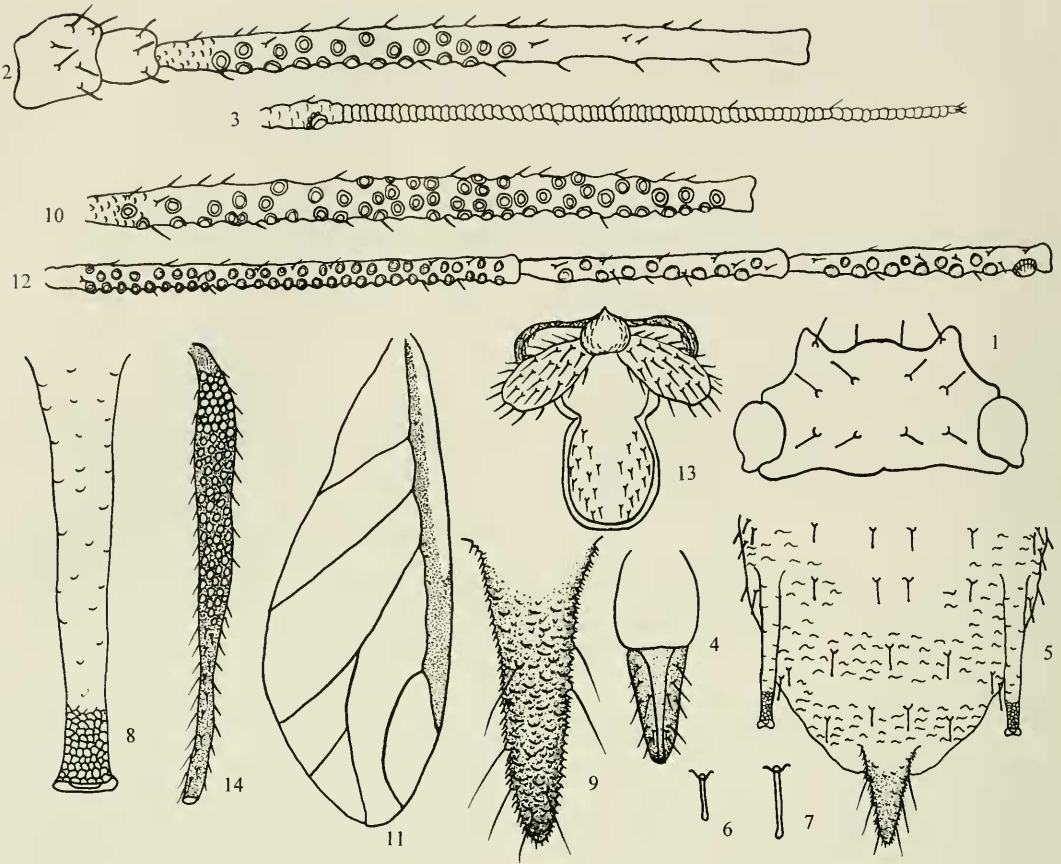
Hebei (Kuancheng County, Wulinshan Mountain, Xiaowutai Mountain); Japan
. *Delphiniobium yezoense* Miyazaki

KEY TO ALATE VIVIPAROUS FEMALES OF SPECIES FROM CHINA

- 1. Siphunculi distinctly swollen; antennal segment III longer than segments IV + V 2
- Siphunculi indistinctly swollen; antennal segment III shorter than segments IV + V 3
- 2. Antennal segment III with 77–81 secondary rhinaria; yellow in life; siphunculus 2.00 times as long as cauda; China: Qinghai (Huzhu County), Xizang (Gyamda County)
. *Delphiniobium gyamdaense* Zhang
- Antennal segment III with 40–65 secondary rhinaria; bluish green in life; siphunculus 1.60–1.70 times as long as cauda; China: Hebei (Kuancheng County, Wulinshan Mountain, Xiaowutai Mountain), Sichuan (An County); Japan
. *Delphiniobium yezoense* Miyazaki
- 3. Median frontal tubercle indistinct; ultimate rostral segment 1.06 times as long as second hind tarsal segment; siphunculi 1.74 times as long as cauda; China: Shanxi (Yangcheng County)
. *Delphiniobium violisuctum*
Qiao and Zhang, n. sp.
- Median frontal tubercle distinct; ultimate rostral segment 1.40 times as long as second hind tarsal segment; siphunculi 2.00 times as long as cauda; China: Beijing (Sanpu District, Xiaolongmen District)
. *Delphiniobium aconitifoliae*
Zhang and Qiao, n. sp.

Delphiniobium aconitifoliae Zhang and Qiao, new species (Figs. 1–14)

Description.—Measurements: *Apterous viviparous female*: Body 3.56 in length, 1.78 in width. Antenna 3.72, length of segments I–VI 0.15, 0.09, 1.20, 0.59, 0.50, 0.12+1.08, respectively. Ultimate rostral segment 0.19 in length, 0.09 in basal width. Hind femur 1.41, hind tibia 2.53, second hind tarsal segment 0.16. Siphunculus 0.72 in length. Cauda 0.50 in length. *Alate viviparous females*: Body 3.20 in length, 1.18 in width. Antenna 3.93, length of segments I–VI 0.14, 0.10, 1.14, 0.62, 0.58, 0.12+1.23, respectively. Ultimate rostral segment 0.21 in length, 0.11 in basal width. Hind femur 1.38, hind tibia 2.51, second hind tarsal segment 0.15. Siphunculus 0.72 in length. Cauda 0.37 in length. *Alate male*:



Figs. 1-14. *Delphinioobium aconitifoliae*. 1-9, Apterous viviparous female. 1, Dorsal view of head. 2, Antennal segments I-III. 3, Antennal segment VI. 4, Ultimate rostral segment. 5, Dorsal view of abdominal segments V-VIII. 6, Dorsal hair of body. 7, Ventral hair. 8, Siphunculus. 9, Cauda. 10-11, Alate viviparous female. 10, Antennal segment III. 11, Fore wing. 12-13, Alate male. 12, Antennal segments III-V. 13, Clasper. 14, Oviparous female, hind tibia.

Body 2.64 in length, 1.13 in width. *Oviparous female*: Body 3.61 in length, 1.83 in width.

Apterous viviparous female: Body oval, red and yellow in life. Mounted specimens: Head grey, thorax and abdomen pale, without patches. Antenna black except base of antennal segment III pale; rostral segments III-V, distal half of femora, tibiae and tarsi black, siphunculi pale at base, brown at middle, black distally, cauda and anal plate black, genital plate pale. Abdominal segments VII and VIII with slight imbrications. Spiracles large, closed, spiracular plates slightly brown. Mesosternal furca with short stem, pale. Dorsal hairs of body thick

and short, stout at apex. Ventral hairs similar to but longer than dorsal hairs. Head with 1 pair cephalic hairs, 1 pair antennal tubercular hairs, 4-5 pairs dorsal hairs. Pronotum with 1 pair spinal, 1 pair pleural and 1 pair marginal hairs. Abdominal tergites I-VI each with 4-6 spino-pleural hairs, tergite VII with 2 or 3; tergites II-VII each with 2-3 pairs marginal hairs, tergite I with 1 pair marginal hairs, tergite VIII with 2 pairs hairs. Length of cephalic hairs 0.04, length of marginal hairs on abdominal tergite I 0.03, and length of dorsal hairs on tergite VIII 0.05, 0.52 times, 0.39 times and 0.75 times as long as widest diameter of antennal segment III, respectively. Median

frontal tubercle developed, antennal tubercles developed and diverging, higher than median front. Antenna 6-segmented, basal part of segment III and segments IV–VI with distinct imbrications, length 1.10 times as long as body; length in proportion to segments I–VI: 13, 7, 100, 49, 41, 10+90, respectively. Antennal hairs similar to dorsal hairs, segments I–VI each with 6 or 7, 4, 25–31, 7–13, 7–10, 3 or 4 +3–8 hairs, respectively, apex of processus terminalis with 3 hairs. Length of hairs on antennal segment III 0.04, 0.57 times as long as widest diameter of segment. Antennal segment III with 21–39 large and small round secondary rhinaria (Fig. 2) on basal $\frac{2}{3}$ of segment. Rostrum thick and large, reaching midcoxae, clypeus with 2 pairs hairs anteriorly; ultimate rostral segment 2.00 times as long as its basal width, 1.20 times as long as second hind tarsal segment, with 7 pairs hairs, 3–4 pairs accessory hairs among them. Hind femur 1.20 times as long as antennal segment III. Hind tibia 0.71 times as long as body. Length of hairs on hind tibia 0.06, 0.93 times as long as middle tibia width of segment. First tarsal segment chaetotaxy: 3, 3, 3. Siphunculi long, tapering, slightly constricted at distal $\frac{1}{4}$, with 12–14 rows of reticulations at constricted part; 0.20 times as long as body, 1.40 times as long as cauda; with flange. Cauda tapering, rough, with spinulose imbrications; with 6–8 thick and long hairs. Anal plate circular at apex, with 11–19 long and short hairs. Genital plate semicircular, with 14–16 hairs.

Alate viviparous female: Mounted specimens: Head and thorax slightly brown, head surrounding eyes black, abdomen pale, without patches. Spiracles large and opened, spiracular plates brown. Marginal areas of body and some abdominal segments behind siphunculi with distinct imbrications. Dorsal hairs of body thick and short, stout at apex. Head with 1 pair cephalic hairs, 2–3 pairs antennal tubercular hairs, 4 pairs dorsal hairs. Abdominal tergites I–VII each with 3 or 4 spinal, 1 pair

pleural and 4–8 pairs marginal hairs, tergite VIII with 2–3 pairs hairs. Length of cephalic hairs 0.04, length of marginal hairs on abdominal tergite I 0.03, and length of dorsal hairs on tergite VII 0.05, 0.61 times, 0.49 times and 0.72 times as long as widest diameter of antennal segment III, respectively. Antenna 6-segmented, 1.20 times as long as body; length in proportion to segments I–VI: 12, 8, 100, 55, 51, 10+107, respectively. Antennal segment III with 29–36 hairs, length 0.03, 0.46 times as long as widest diameter of segment. Antennal segment III with 46–73 large and small round secondary rhinaria, on entire segment. Rostrum reaching midcoxae, ultimate rostral segment 1.40 times as long as second hind tarsal segment, with 8–9 pairs hairs, 5–6 pairs accessory hairs among them. Hind femur 1.21 times as long as antennal segment III. Hind tibia 0.79 times as long as body. Veins normal. Siphunculi swollen at distal half, constricted at apex, 0.23 times as long as body, 2.00 times as long as cauda. Cauda long, tapering, with 7 hairs. Anal plate with 17–19 hairs. Other characters similar to apterous viviparous female.

Alate male: Body long oval. Mounted specimens: Antenna, rostrum, distal half of femora, tibiae, tarsi, siphunculi, cauda, anal plate dark brown, other appendages slightly brown. Abdominal tergites I–V each with 1 pair spino-pleural and 1 pair marginal patches. Dorsal hairs of body with sclerites at base. Dorsal hairs slightly short, ventral hairs longer than dorsal hairs. Antenna 6-segmented, 1.50 times as long as body. Secondary rhinaria small round, on segments III–V; segment III with 53–63, segment IV with 8–11, segment V with 7–11. Forewing media two-branched, hindwing two obliques. Clasper shown in Fig. 13. Other characters similar to alate viviparous female.

Oviparous female: Body oval. Mounted specimens: Antennal segments I–III, distal part of segment IV, distal part of segment V, basal part of segment VI, distal part of rostrum, distal half of femora, tibiae, tarsi,

cauda, anal plate, distal $\frac{1}{5}$ of siphunculi dark brown, other appendages slightly brown; basal $\frac{1}{5}$ of siphunculi pale, rest of siphunculi slightly brown. Genital plate slightly brown. Antennal segment III with 12–18 small round secondary rhinaria, on basal half of segment. Hind tibia swollen at basal half, with about 250 small round pseudo-sensoria. Other characters similar to apterous viviparous female.

Diagnosis.—The new species differs from *D. yezoense* Miyazaki as follows: Clypeus with 4 hairs (*yezoense*, 2 hairs), basal and distal of antennal segment III and basal of segment IV pale (*yezoense*, black, except basal of segment III), and yellow or red in life (*yezoense*, green or bluish green). It differs from *D. bogdoui* Szelegiewicz as follows: Antennal segment V black (*bogdoui*, basal part of segment pale), yellow or red in life (*bogdoui*, shining brown in life), and length of dorsal hairs of body 0.33 (*bogdoui*, 0.45).

Etymology.—The species name is based on the host plant, *Aconitum kusnezofii*.

Holotype.—Apterous viviparous female, No. 6804-1-2-3, 1978-VI-8, China, Beijing (Sanpu District, 116.4°E, 89.9°N), Col. G. X. Zhang and T. S. Zhong, on young twigs and upper of leaves of *Aconitum kusnezofii* Reichb.

Paratypes.—Two apterous viviparous females and 2 alate viviparous females, No. 6804, other data same as holotype; 2 alate viviparous females, 5 apterous females and 2 alate males, No. 6502, 1976-X-5, Col. B. L. Zhang, other data same as holotype; 2 apterous viviparous females, 1 alate viviparous female, 3 alate males and 12 apterous females, No. 6628, 1977-X-14, other data same as holotype; 5 apterous viviparous females and 3 alate viviparous females, No. 6230, 1976-V-18, other data same as holotype; 1 apterous viviparous female, 1 alate viviparous female and 2 apterous females, No. 11535, 1997-IX-11, China, Beijing (Xiaolongmen District, 116.0°E, 39.9°N), Col. J. G. Xiangyu, on *Aconitum* sp.

Delphiniobium gyamdaense Zhang 1981
(Figs. 15–21)

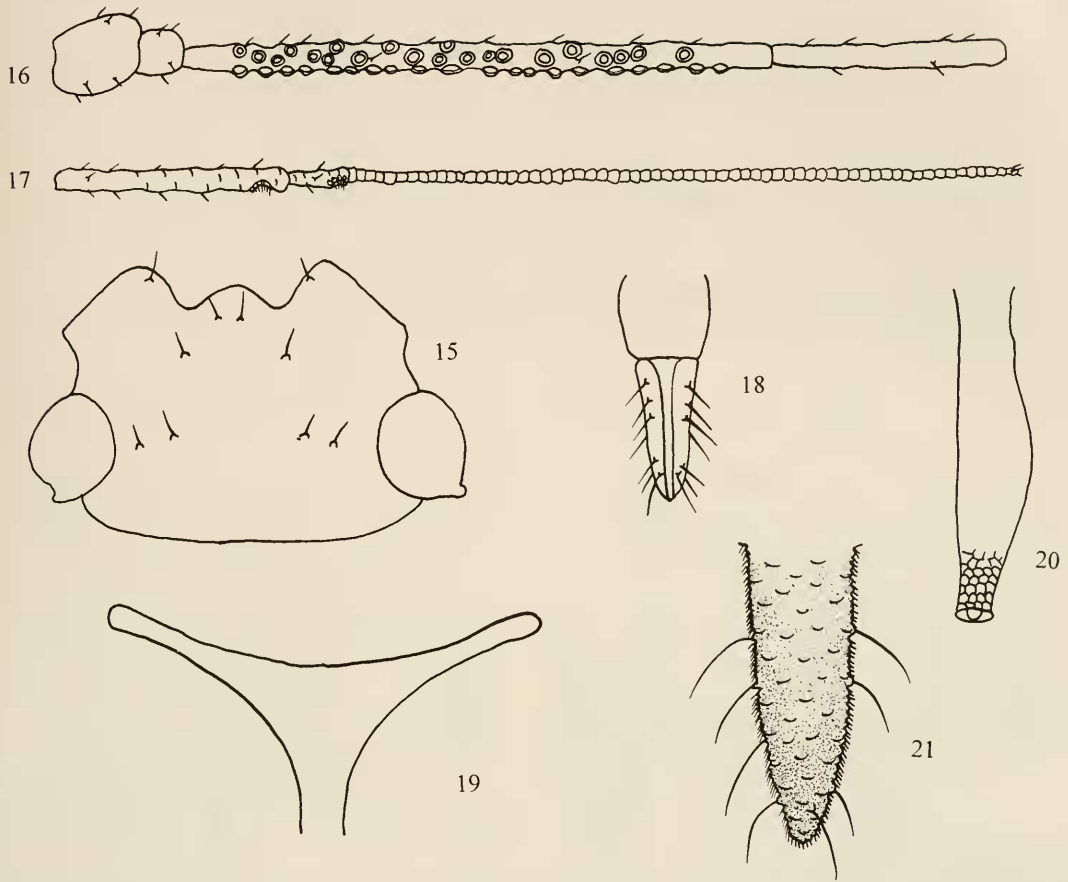
Delphiniobium gyamdaense Zhang 1981:
264.

Description.—*Apterous viviparous female*: Body 3.04 in length, 1.50 in width. Body elliptical, yellow in life, siphunculi, antennae, legs and cauda black. Mounted specimens: Head and prothorax slightly brown, mesonotum, metanotum and abdomen pale, without patches. Antennal segments dark brown, except basal part of segment III and distal part of segment VI; distal part of rostrum, distal half of femora, distal part of tibiae and tarsi dark brown; distal $\frac{1}{6}$ of siphunculi, cauda and anal plate dark brown, others pale. Mesosternal furca with long stem. Median frontal tubercle slightly developed, antennal tubercles developed, higher than median frontal tubercle. Antenna 6-segmented, about as long as body; length in proportion to segments I–VI: 13, 8, 100, 40, 40, 10+115. Antennal segment III with 44–46 round secondary rhinaria, over the entire segment. Length of hairs on segment III $\frac{1}{2}$ as long as widest diameter of segment. Rostrum exceeding midcoxae, ultimate rostral segment 2.35 times as long as its basal width, with 8 accessory hairs. Siphunculi long barrel-shaped, swollen at middle, width at swollen part 1.90 times distal width, distal $\frac{1}{6}$ with reticulations, 0.16 times as long as body, 1.25 times as long as cauda. Cauda long tapering, indistinctly constricted, 2.56 times as long as its basal width, with 6 hairs. Anal plate with 16 hairs.

Specimens examined.—Three apterous viviparous females, No. 11391, 1997-VI-8, China: Qinghai (Huzhu County, 101.9°E, 36.8°N), Col. X. L. Chen, on *Aconitum* sp., Xizang (Gyamda County, 93.1°E, 29.9°N).

Delphiniobium violisuctum Qiao and
Zhang, new species
(Figs. 22–31)

Description.—Measurements: *Apterous viviparous female*: Body 3.13 in length,

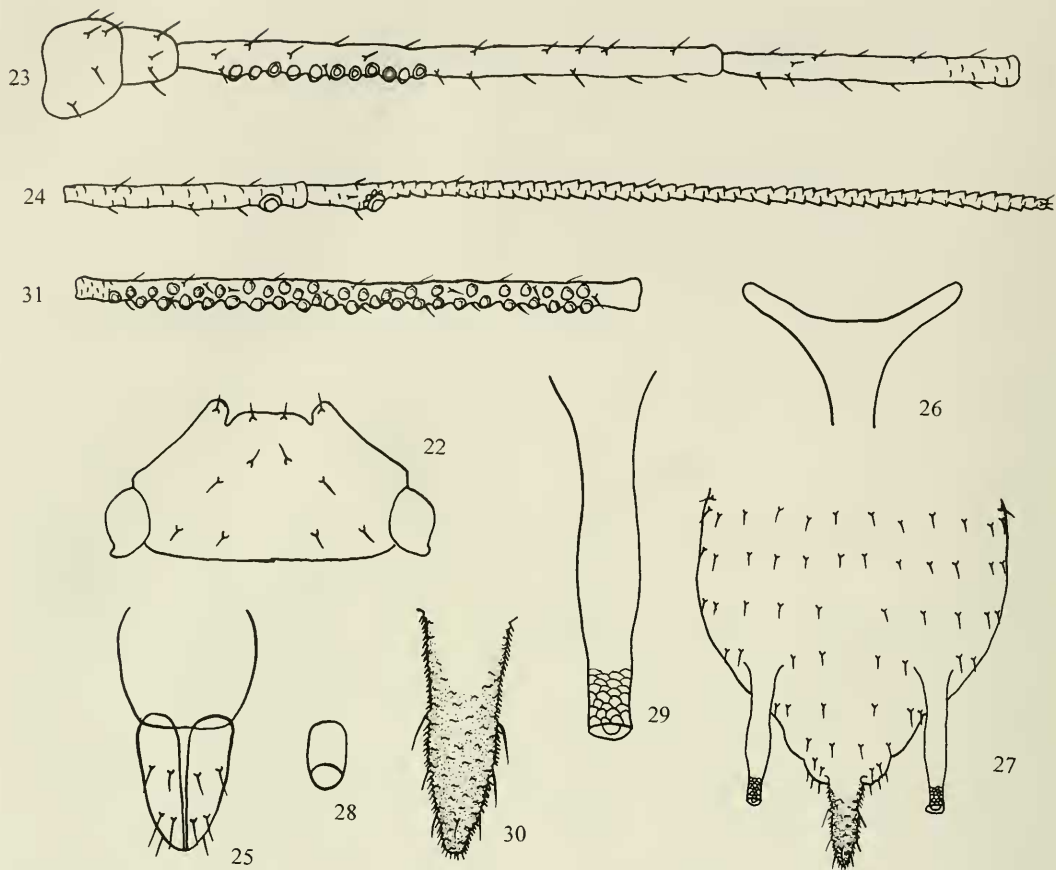


Figs. 15–21. *Delphiniobium gyamdaense*, apterous viviparous female. 15, Dorsal view of head. 16, Antennal segments I–IV. 17, Antennal segments V and VI. 18, Ultimate rostral segment. 19, Mesosternal furca. 20, Siphunculus. 21, Cauda.

1.43 in width. Antenna 3.70, length of segments I–VI 0.14, 0.10, 1.10, 0.56, 0.46, 0.14+1.27, respectively. Ultimate rostral segment 0.12 in length. Hind femur 1.37, hind tibia 2.30, second hind tarsal segment 0.16. Siphunculus 0.67 in length. Cauda 0.45 in length. *Alate viviparous female*: Body 3.40 in length, 1.58 in width.

Apterous viviparous female: Body large, dark green in life, on upper side of leaves. Mounted specimens: Head and prothorax brown, antennal segments I and II, distal $\frac{7}{8}$ of segment III, distal $\frac{1}{3}$ of segment IV, distal half of segment V, basal part of segment VI and distal half of processus terminalis dark brown, others brown; apex of rostrum, distal $\frac{3}{5}$ of femora, distal $\frac{1}{6}$ of tibiae, tarsi,

distal $\frac{1}{4}$ of siphunculi, cauda and anal plate dark brown, coxae, trochanters, basal $\frac{1}{5}$ of femora, basal $\frac{1}{5}$ of siphunculi and genital plate slightly brown, others brown. Spiracles large, oval, opened; spiracular plate long oval, slightly pale. Mesosternal furca with long stem. Dorsal hairs of body thick, short, stout at apex. Head with 1 pair of cephalic hairs and 1 pair antennal tubercular hairs, 4 pairs dorsal hairs; pronotum with 3 pairs spinal, 2 pairs pleural and 1 pair marginal hairs; abdominal tergite I with 14 hairs, tergite VII with 4 hairs. Length of cephalic hairs 0.04, length of marginal hairs on tergite I 0.03, and length of dorsal hairs on tergite VII 0.05, 0.73 times, 0.55 times and 0.91 times as long as



Figs. 22-31. *Delphiniobium violisuctum*. 22-30, Apterous viviparous female. 22, Dorsal view of head. 23, Antennal segments I-IV. 24, Antennal segments V and VI. 25, Ultimate rostral segment. 26, Mesosternal furca. 27, Dorsal view of abdominal tergites III-VIII. 28, Spiracle on abdominal segment II. 29, Siphunculus. 30, Cauda. 31, Alate viviparous female, antennal segment III.

widest diameter of antennal segment III, respectively. Median frontal tubercle undeveloped, antennal tubercles distinct, higher than median frontal tubercle, slightly diverging at inner margins. Antenna 6-segmented, 1.18 times as long as body, length in proportion to segments I-VI: 14, 10, 100, 54, 45, 14+123. Processus terminalis 9.11 times as long as base of segment. Antennal hairs similar to dorsal hairs, antennal segments I-VI each with 7, 4, 30, 11, 6, 3+3 hairs, respectively, apex of precessus terminalis with 3 hairs. Length of hairs on antennal segment III 0.04, 0.64 times as long as widest diameter of segment. Antennal segment III with 11 small round secondary

rhinaria, on basal half of segment. Rostrum reaching midcoxae, ultimate rostral segment thick, 1.33 times as long as its basal width, 0.87 times as long as second hind tarsal segment; with 2 pairs accessory hairs. Legs normal. Hind femur 1.33 times as long as antennal segment III. Hind tibia 0.72 times as long as body. Hairs on legs slightly longer than dorsal hairs of body. Length of hairs on hind tibia 0.07, 1.40 times as long as middle width of segment. First tarsal segment chaetotaxy: 3, 3, 3. Siphunculus long barrel-shaped, 3.42 times as long as basal width, 8.13 times as long as distal width, 0.21 times as long as body, 1.48 times as long as cauda, swollen at middle,

distal $\frac{1}{6}$ of siphunculi with reticulations. Cauda long, tapering, slightly constricted at middle, 2.44 times as long as its basal width, with 7 hairs. Anal plate circular at apex, with 18 hairs. Genital plate with 15 hairs, 2 long anterior hairs among them. Gonapophyses three, each with 5 or 6 hairs.

Alate viviparous female: Body large. Mounted specimens: Basal of antennal segment III pale, distal $\frac{1}{3}$ of tibiae black, distal half of femora, and other antennal segments slightly brown, other appendages dark brown; dorsum of head brown; distal of rostrum, cauda, and anal plate greyish brown; basal $\frac{2}{3}$ of siphunculi slightly brown, distal $\frac{1}{5}$ of siphunculi dark brown. Abdominal dorsum without patches. Antenna 6-segmented, segment III with 42–47 small round secondary rhinaria, on entire segment. Fore wing veins brown, media two-branched. Other characters similar to apterous viviparous females.

Diagnosis.—The new species is similar to *D. bogdouli* Szelegiewicz from Mongolia by the median frontal tubercle and antennal tubercles, but differs as follows: antennal segment III with 42–47 secondary rhinaria in alatae (*bogdouli*, 58–62); ultimate rostral segment 0.87 times as long as second hind tarsal segment (*bogdouli*, longer than, 1.10 times); siphunculi slightly swollen at middle (*bogdouli*, indistinctly swollen); and dark green in life (*bogdouli*, shining brown).

Etymology.—The new species is named based on the host plant, *Viola verecunda*.

Holotype.—Apterous viviparous female, No.Y8070-1-1-1, China: Shanxi (Yangcheng County, 112.4°E, 35.5°N), Col. Fei Zhao, 1996-VI-1, on *Viola verecunda*.

Paratypes.—One alate viviparous female and 1 apterous larvae, No.Y8070, other data same as holotype.

Delphiniobium yezoense Miyazaki 1971

Delphiniobium yezoense Miyazaki 1971: 34(1):40.

Distribution.—No.Y4347, China: Hebei (Wulinshan Mountain, 117.4°E, 40.6°N),

1983-IX-12, Col. S.P. Tian; No.Y5718, China: Hebei (Kuancheng County, 118.4°E, 40.6°N), 1983-IX-9, Col. S.P. Tian; No.Y5597, China: Hebei (Xiaowutai Mountain, 115.°E, 89.9°N), 1984-VI-22, Col. S.P. Tian; No.Y1598, China: Sichuan (An County, 104.4°E, 31.6°N), 1979-V-22, Col. H.Y. Li; No.Y1436, China: Sichuan (An County), 1978-IX, Col. H.Y. Li; Japan.

Host-plants.—*Aconitum kusnezoffi* and *A. comiichali* (in China); *A. chinense*, *A. kitadakense*, *A. yesoense* and *A. sachalinense* (in Japan).

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